

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 02/05930

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G02B6/42 H01L31/0232

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01L G02B G02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, INSPEC, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DENSMORE A ET AL: "A QUANTUM-WELL WAVEGUIDE PHOTODETECTOR FOR HIGH-PRECISION WAVELENGTH MONITORING ABOUT 1.55 MUM" IEEE PHOTONICS TECHNOLOGY LETTERS, IEEE INC., vol. 11, no. 12, December 1999 (1999-12), pages 1653-1655, XP000926815 New York, USA ISSN: 1041-1135	1,21
A	the whole document --- -/--	2,22-25

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

10 June 2004

Date of mailing of the international search report

23. 07. 2004

Name and mailing address of the ISA

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International Application No

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KESAN V P ET AL: "Integrated waveguide-photodetector using Si/SiGe multiple quantum wells for long wavelength applications" INT. ELECTRON DEVICES MEETING 1990. TECHN. DIGEST (CAT. NO.90CH2865-4), SAN FRANCISCO, 9 - 12 December 1990, pages 637-640, XP010554586 New York, USA	1,21
A	the whole document	2,22-25
X	EP 0 993 053 A (ST MICROELECTRONICS SRL) 12 April 2000 (2000-04-12)	1,21
A	abstract; figures 2,8 column 5, paragraph 28 -column 6, paragraph 32	2,22-25
A	US 5 572 014 A (WU MING-CHIANG ET AL) 5 November 1996 (1996-11-05) abstract; figures 1,2,11 column 5, line 24 -column 7, line 7	1,2, 21-25
A	YI-YAN A ET AL: "GRAFTED GAAS DETECTORS ON LITHIUM NIBATE AND GLASS OPTICAL WAVEGUIDES" IEEE PHOTONICS TECHNOLOGY LETTERS, IEEE INC. NEW YORK, US, vol. 1, no. 11, 1 November 1989 (1989-11-01), pages 379-380, XP000081611 ISSN: 1041-1135 the whole document	1
A	PATENT ABSTRACTS OF JAPAN vol. 014, no. 278 (E-0941), 15 June 1990 (1990-06-15) & JP 02 087581 A (CANON INC), 28 March 1990 (1990-03-28) abstract	1
A	US 5 233 187 A (TAKEUCHI SHINSUKE ET AL) 3 August 1993 (1993-08-03) abstract; figures	1
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	YOSHIMOTO T ET AL: "SOI WAVEGUIDE GESI AVALANCHE PIN PHOTODETECTOR AT 1.3UM WAVELENGTH" IEICE TRANSACTIONS ON ELECTRONICS, INSTITUTE OF ELECTRONICS INFORMATION AND COMM. ENG. TOKYO, JP, vol. E81-C, no. 10, October 1998 (1998-10), pages 1667-1669, XP000860773 ISSN: 0916-8524 the whole document	1,21
A	DE 41 19 093 A (MESSERSCHMITT BOELKOW BLOHM) 17 December 1992 (1992-12-17) the whole document	3-7
A	US 4 857 973 A (YANG ANDREW C ET AL) 15 August 1989 (1989-08-15) abstract; figures 6,9,10	3-7
A	WU X ET AL: "INLINE QUANTUM-WELL WAVEGUIDE PHOTODETECTORS FOR THE MEASUREMENT OF WAVELENGTH SHIFTS" JOURNAL OF LIGHTWAVE TECHNOLOGY, IEEE. NEW YORK, US, vol. 15, no. 12, 1 December 1997 (1997-12-01), pages 2278-2283, XP000727518 ISSN: 0733-8724 the whole document	3-7

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Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☒ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
1-7, 21-25
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1,2,21-25

An integrated optical waveguide and a method having an in-line light sensor integrally formed therewith, comprising a first and a second waveguide leading to and from the photodiode, the photodiode comprises one or more regions of light absorbing material to absorb a minor proportion of light of one or more selected wavelengths transmitted along the waveguide and thereby to generate free charge carriers within the waveguide; and detecting means for detecting the presence of said free charge carriers; the material of the waveguide is adapted to detect a first wavelength; the photodiode being modified to introduce deep bandgap levels in order to provide at least partial absorption of photons of an optical signal of a selected wavelength or wavelength band greater than said first wavelength.

2. Claims: 3-7

A photodiode according to claim 1 characterized by the fact that the modification of the photodiode comprises the presence of defects in the intrinsic region

3. Claims: 8-12, 14,15

An integrated optical waveguide according to claim 1 whereby the detecting means comprises a diode

4. Claims: 13-17

A waveguide according to claim 1 whereby a rib is formed projecting from a slab.

5. Claim : 18

A waveguide according to claim 1 characterized by the fact that the refractive index of the material and the dimensions are selected so as to provide similar confinement factors for both TE and TM modes whereby the detection of light is substantially polarisation independent

6. Claims: 19,20

A waveguide according to claim 1 whereby the waveguide is formed of silicon

FURTHER INFORMATION CONTINUED FROM PCT/SA/ 210

7. Claims: 26-33

A waveguide according to claim 1 having a wavelength selective reflector means being arranged to reflect light of said selected wavelength or range of wavelengths so it passes repeatedly through the photodiode

8. Claims: 34,35

A waveguide according to claim 1 comprising an optical attenuator for attenuating the light passing through the in-line light sensor

9. Claims: 36-42

A waveguide according to claim 1 having two or more in-line light sensors arranged in series or in parallel

10. Claim : 43

An integrated optical waveguide comprising a PIN diode formed in a semiconductor substrate having an energy bandgap; the magnitude of the band gap corresponds to absorption of photons of a first wavelength the photodiode comprising a substantially intrinsic region; the photodiode being modified to introduce deep bandgap levels; the photodiode being provided within a resonant cavity

INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0993053	A	12-04-2000	EP 0993053 A1	12-04-2000
			JP 2000164841 A	16-06-2000
			US 6433399 B1	13-08-2002
US 5572014	A	05-11-1996	NONE	
JP 02087581	A	28-03-1990	NONE	
US 5233187	A	03-08-1993	DE 69220585 D1	07-08-1997
			DE 69220585 T2	05-02-1998
			EP 0496348 A2	29-07-1992
			JP 3149979 B2	26-03-2001
			JP 5090715 A	09-04-1993
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